GP-303269

IN THE CLAIMS

1. (currently amended) An impact energy absorbing system comprising:

a control structure comprising a sleeve, a seal at each end of the sleeve, a magnetorheological fluid disposed between the seals, and at least one coil in proximity to the magnetorheological fluid; and

a primary impact surface fixedly attached to a support member, wherein the support member is in sliding engagement with the seal and the magnetorheological fluid of the control structure, wherein the magnetorheological fluid is not displaced by the support member ~~essentially does not flow~~ to effect the sliding engagement.

2. (Original) The impact energy absorbing system of Claim 1, wherein the control structure is fixedly attached to a vehicle chassis.

3. (Original) The impact energy absorbing system of Claim 2, further comprising a secondary impact surface disposed within an annular recess of the support member comprising a spring having one end fixedly attached to a transverse member and an other end fixedly attached to the secondary impact surface, wherein the transverse member is fixedly attached to the vehicle chassis.

4. (Original) The impact energy absorbing system of Claim 1, wherein the support member is formed of a soft magnetic material.

5. (Original) The impact energy absorbing system of Claim 1, wherein the magnetorheological fluid comprises carbonyl iron and an inorganic material selected from the group consisting of zinc oxide, silicon dioxide, molybdenum sulfide, and boron nitride.

6. (Original) The impact energy absorbing system of Claim 1, wherein the magnetorheological fluid comprises ferromagnetic or paramagnetic particles or particulates dispersed in a carrier fluid.

7. (Original) The impact energy absorbing system of Claim 6, wherein the particles are in an amount of about 5 to about 75 percent by volume of the magnetorheological fluid.

8. (Original) The impact energy absorbing system of Claim 1, further comprising a permanent magnet in proximity to the magnetorheological fluid.

9. (currently amended) An impact energy absorbing system comprising:

a control structure comprising a sleeve, a seal at each end of the sleeve, a magnetorheological fluid, and a permanent magnet in proximity to the magnetorheological fluid to define a fixed yield stress; and

an impact surface fixedly attached to a support member, wherein the support member is slidably disposed against the seal and the magnetorheological fluid, wherein the magnetorheological fluid is not displaced by the support member ~~essentially does not flow~~ to effect sliding of the support member.

10. (Original) The impact energy absorbing system of Claim 9, wherein the control structure is fixedly attached to a vehicle chassis.

11. (Original) The impact energy absorbing system of Claim 10, further comprising a secondary impact surface disposed within an annular recess of the support member comprising a spring having one end fixedly attached to a transverse member and an other end fixedly attached to the secondary impact surface, wherein the transverse member is fixedly attached to the vehicle chassis.

12. (Original) The impact energy absorbing system of Claim 9, wherein the support member is formed of a soft magnetic material.

13. (Original) The impact energy absorbing system of Claim 9, wherein the magnetorheological fluid comprises carbonyl iron and an inorganic material selected from the group consisting of zinc oxide, silicon dioxide, molybdenum sulfide, and boron nitride.

14. (Original) The impact energy absorbing system of Claim 9, wherein the magnetorheological fluid comprises ferromagnetic or paramagnetic particles or particulates dispersed in a carrier fluid.

15. (Original) The impact energy absorbing system of Claim 14, wherein the particles are in an amount of about 5 to about 75 percent by volume of the magnetorheological fluid.

16. (Original) The impact energy absorbing system of Claim 14, wherein the permanent magnet in proximity to the magnetorheological fluid is at a distance effective to impart a magnetic field on the magnetorheological fluid.

17. (Original) The impact energy absorbing system of Claim 9, further comprising an electromagnet in proximity to the magnetorheological fluid.

18. (currently amended) A process for absorbing energy from an impact of an object upon an impact surface, the process comprising:

detecting an impact with a sensor, wherein the sensor is in operative communication with an impact energy absorbing system fixedly attached to the impact surface and a vehicle chassis, wherein the impact surface is attached to a support member in sliding engagement with the impact energy absorbing system and wherein the magnetorheological fluid is not displaced by the support member ~~essentially does not flow~~ to effect the sliding engagement;

variably changing a magnetic field within the impact energy absorbing system to alter the shear force of the sliding engagement in response to a signal provided by the sensor; and

absorbing energy from the impact with the impact energy absorbing system or the impact energy absorbing system and the vehicle chassis.

19. (Original) The process according to Claim 18, wherein variably changing the magnetic field comprises changing a yield strength of a magnetorheological fluid in fluid contact with the support member.

20. (Original) The process according to Claim 19, wherein the magnetorheological fluid comprises carbonyl iron and an inorganic material selected from the group consisting of zinc oxide, silicon dioxide, molybdenum sulfide, and boron nitride.

21. (Original) The process according to Claim 18, wherein variably changing the magnetic field comprises changing a current to a coil in proximity to the magnetorheological fluid.

22. (Original) The process of Claim 18, wherein the impact energy absorbing system can be used multiple times.

23. (Original) The process of Claim 18, further comprising restoring the impact surface to its original position with a spring having one end fixedly attached to a transverse member attached to the vehicle chassis and an other end fixedly attached to a secondary impact surface, wherein the secondary impact surface is disposed within an annular recess of the support member and is displaced as the spring compresses upon the impact and returns to its original position upon expansion of the spring after the impact.

24. (Previously presented) An impact energy absorber device, comprising:

a primary impact surface fixedly attached to a shaft, wherein a support member is slidably engaged with a housing;

a plurality of plates disposed in the housing, wherein each plate is substantially parallel to an adjacent plate, and wherein the plurality of plates are alternatingly attached to the support member and a framing member of the housing to define a space between adjacent plates;

a magnetorheological fluid disposed in the space; and

an electromagnet or permanent magnet in proximity to the magnetorheological fluid.

25. (Previously presented) The impact energy absorber device of Claim 24, wherein the magnetorheological fluid comprises carbonyl iron and an inorganic material selected from the group consisting of zinc oxide, silicon dioxide, molybdenum sulfide, and boron nitride.

26. (Previously presented) An impact energy absorbing system comprising:

a control structure fixedly attached to a vehicle chassis comprising a sleeve, a seal at each end of the sleeve, a magnetorheological fluid disposed between the seals, and at least one coil in proximity to the magnetorheological fluid;

a primary impact surface fixedly attached to a support member, wherein the support member is in sliding engagement with the seal and the magnetorheological fluid of the control structure; and

a secondary impact surface disposed within an annular recess of the support member comprising a spring having one end fixedly attached to a transverse member and an other end fixedly attached to the secondary impact surface, wherein the transverse member is fixedly attached to the vehicle chassis.

27. (Previously presented) An impact energy absorbing system comprising:

a control structure fixedly attached to a vehicle chassis comprising a sleeve, a seal at each end of the sleeve, a magnetorheological fluid, and a permanent magnet in proximity to the magnetorheological fluid to define a fixed yield stress;

an impact surface fixedly attached to a support member, wherein the support member is slidably disposed against the seal and the magnetorheological fluid; and

a secondary impact surface disposed within an annular recess of the support member comprising a spring having one end fixedly attached to a transverse member and another end fixedly attached to the secondary impact surface, wherein the transverse member is fixedly attached to the vehicle chassis.